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Can we detect outbreaks at herd-level earlier when combining multiple data sources?

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The aim of this study was to explore the potential of using multiple data sources for monitoring swine diseases.

A total of 81 Danish breeding herds with known changes in disease status were included in the study. Disease status was defined based on monthly serology diagnostic tests performed between January 2014 and September 2017. Changes in mortality data, as well as antimicrobial consumption and vaccine use at herd-level, were monitored in herds that became positive for Porcine Reproductive and Respiratory Syndrome (PRRS), enzootic pneumonia (*Mycoplasma hyopneumonia*) and porcine pleuropneumonia (*Actinobacillus pluropneumoniae*). The analysis was run separately for each age-group - weaners (up to 30kg), sows and finishers - within each herd and alarms were generated based on Shewhart control charts. The alarms from the multiple data streams were integrated before, during and after the herds changed status with respect to a disease.

An increase of alarms based on mortality and antimicrobial use for respiratory diseases was seen for sows and finishers two months before becoming positive for PRRS. For enzootic pneumonia, increases in the number of alarms for weaners, sows, and finishers based on mortality and antimicrobial consumption were found 3, 2 and 1 months before these herds changed their official status. Increases in the number of alarms based on mortality data, as well as antimicrobial and vaccine use were seen in the same month when sows and weaners became positive for porcine pleuropneumonia.

Monitoring changes in mortality data, as well as antimicrobial consumption and vaccine use, evidenced changes in herd-level suggestive of on-going outbreaks before diagnostic test confirmation. The integration of multiple data sources is a good proxy for disease occurrence deriving better monitoring and surveillance systems and control and eradication programs at a national scale.

Research impact highlights: Monitoring existing animal health databases (i.e. big data) is a growing field, providing a more cost-effective alternative to collect primary data. Monitoring changes in mortality data, as well as antimicrobial consumption and vaccine use in Danish breeding herds, evidenced changes in herd-level suggestive of on-going outbreaks before diagnostic test confirmation. The integration of multiple data sources is a good proxy for disease occurrence deriving better monitoring and surveillance systems and control and eradication programs at a national scale. These findings are closely linked to the conference themes of "Surveillance design and big data" and "Research and surveillance policies".

Keywords: outbreaks - early warning - big data - swine